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EXAMINER

ARANCIBIA, MAUREEN GRAMAGLIA

ART UNIT PAPER NUMBER

1763

DATE MAILED: 02/09/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/784,697

Applicant(s)

MARTIN ET AL.

Examiner

Maureen G. Arancibia

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 November 2005.
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11 and 16-26 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 1-11 and 16-26 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Species A, corresponding to previously pending claims 1-11 and 16-18 and newly added claims 19-26, in the reply filed on 18 November 2005 is acknowledged.
2. The Examiner notes the cancellation of Claims 12-15, drawn to non-elected Species B.

Terminal Disclaimer

3. The terminal disclaimer filed on 18 November disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of U.S. Patent No. 6,033,587 to Martin et al. has been reviewed and is accepted. The terminal disclaimer has been recorded.

Claim Objections

4. **Claims 3 and 8 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.**

Specifically, the recitation in Claims 3 and 8 that the additional structure is ac electrically biased would seem to fail to further limit independent Claim 1, since the recitation in independent Claim 1 that the additional structure is biased by a pulse waveform power source would seem to require an ac electrical bias; i.e. a pulse waveform electrical bias is a type of ac electrical bias.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

6. **Claims 1-11 and 19-26 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter that was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.**

Specifically, the amendment to independent Claim 1 and the limitation recited in new Claim 19, to require a *pulse waveform power source adapted to electrically bias the additional structure* to direct electrons from the plasma towards the substrate, as well as the recitations in new Claims 20-26 of further characteristics of the pulse waveform power source (ex. that the positive potential is such that electrons having kinetic energy less than 100 electron-volts are attracted to the substrate), appear to lack support in the original disclosure. The only disclosure of a pulse waveform power source appears to be of such a power source connected to the mechanical support. (Specification, Paragraph 59) Also, there is no explanation in the original disclosure of pulse waveforms being supplied to *both* the mechanical support and the additional structure in such a way as to neutralize charge build-up on the substrate or to direct electrons with a particular energy to the substrate; i.e. of two pulse waveforms somehow working in concert to attain the same result as one pulse waveform. Applicant is requested to

specifically point out and clarify support for these new limitations in the original disclosure, and to cancel any new matter in the claims. Claims 2-11 are rejected due to their dependence on independent Claim 1.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. **Claims 1-11 and 23-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 4,950,376 to Hayashi et al. in view of U.S. Patent 5,279,669 to Lee.**

Hayashi et al. teaches an apparatus for dry etching a substrate (Figure 1), comprising: a plasma reactor 15 for containing a plasma; a mechanical support 16 isolated from the creation of the plasma (Figure 1); and an additional structure 30 capable of being electrically biased (Column 5, Lines 57-58), the additional structure disposed within the plasma reactor proximal to the mechanical support (Figure 1), at least a portion of the additional structure extending into the plasma at a time when the plasma reactor contains the plasma (Column 3, Lines 9-12).

In regards to Claims 1-4, Hayashi et al. teaches that the additional structure 30 is dc electrically biased (Column 5, Lines 57-58).

Hayashi et al. does not expressly teach a pulse waveform power source adapted to electrically bias the additional structure to direct electrons from the plasma towards the substrate, or that the additional structure can be both ac and dc electrically biased.

Lee teaches that an additional structure 60 can be ac electrically biased by a pulse waveform power source 64 that alternately attracts negatively and positively charged particles towards the substrate. (Column 6, Line 50 - Column 7, Line 25)

It would have been obvious to one of ordinary skill in the art to modify the additional structure taught by Hayashi et al. to be both ac and dc electrically biased by adding a pulse waveform power source connected to the additional structure, as taught by Lee. The motivation for doing so, as taught by Lee (Column 6, Line 50 - Column 7, Line 25), would have been to generate a pulsed charged-particle beam with a desired base voltage.

The Examiner notes that during the positive swing of the pulse waveform power source, negative particles, including electrons, would be directed to the substrate to perform etching, while during the negative swing of the pulse waveform power source, positive particles would be directed to the substrate. See Lee, Column 6, Line 50 - Column 7, Line 25. This rejection is based on the fact the apparatus structure taught above has the inherent capability of being used in the manner intended by the Applicant. When a rejection is based on inherency, a rejection under 35 U.S.C. 102 or U.S.C. 103 is appropriate. (See *In re Fitzgerald* 205 USPQ 594 or MPEP 2112).

While Hayashi et al. does not expressly state that the apparatus is used for *low-damage anisotropic* dry etching, the apparatus taught by the combination of Hayashi et

al. and Lee is structurally the same as the claimed apparatus, and would be inherently be capable of low-damage anisotropic dry etching. This rejection is based on the fact the apparatus structure taught above has the inherent capability of being used in the manner intended by the Applicant. When a rejection is based on inherency, a rejection under 35 U.S.C. 102 or U.S.C. 103 is appropriate. (See *In re Fitzgerald* 205 USPQ 594 or MPEP 2112).

In regards to Claim 5, Hayashi et al. teaches that the mechanical support is electrically isolated from the plasma creator by insulation 17. (Column 5, Lines 4-8)

In regards to Claim 6, Hayashi et al. teaches that the additional structure is electrically isolated from the mechanical support and the plasma creator by electrically insulating member 32. (Figure 1; Column 5, Lines 51-56)

In regards to Claims 7-9, see the discussion of Claims 2-4 above.

In regards to Claims 10 and 11, the apparatus taught by Hayashi et al. includes an electrically insulating member 32 disposed on and circumscribing a portion of the mechanical support, and in communication with the additional structure. (Figure 1; Column 5, Lines 51-56)

In regards to Claims 23-25, the pulse waveform taught by the combination of Hayashi et al. and Lee cycles between a positive and negative potential to direct particles of alternating charge to the substrate. This pulse waveform would inherently be capable of directing enough ions of one charge towards the substrate to neutralize an existing charge on the substrate, without damaging the substrate.

Moreover, Lee teaches that the voltage supplied to the additional structure is a result-effective variable that determines which particles are energetic enough to reach the substrate and which particles are blocked. (Column 7, Lines 8-25)

Therefore, it would have been obvious to one of ordinary skill in the art to optimize the voltage supplied to the additional structure to optimize the energy of the charged particles that reach the substrate, such that electrons with kinetic energy less than 100 electron-volts reach the substrate to perform etching.

This rejection is based on the fact the apparatus structure taught above has the inherent capability of being used in the manner intended by the Applicant. When a rejection is based on inherency, a rejection under 35 U.S.C. 102 or U.S.C. 103 is appropriate. (See *In re Fitzgerald* 205 USPQ 594 or MPEP 2112).

9. Claims 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hayashi et al. in view of U.S. Patent 6,231,777 to Kofuji et al. (from Applicant's IDS)

In regards to Claim 16, Hayashi et al. teaches an apparatus for dry etching a substrate (Figure 1), comprising: a plasma reactor 15; a plasma creation means (microwaves, waveguide 12, and gas from inlet 14) at least partially disposed within the plasma reactor (the microwaves and gas enter the reactor) for creating a plasma having positively charged ions and electrons (Column 3, Lines 3-8); a substrate holder 16 disposed within the plasma reactor for receiving a substrate 33, wherein the holder is isolated from the creation of the plasma in chamber 11 (Figure 1); and a charged

particle controller means (additional structure 30), the charged particle controller means disposed proximal to the substrate holder (Figure 1).

Hayashi et al. does not expressly state that the apparatus is used for *low-damage anisotropic* dry etching, the apparatus taught by Hayashi et al. is structurally the same as the claimed apparatus, and would be inherently be capable of low-damage anisotropic dry etching. Additionally, the charged particle controller means (additional structure 30) is electrically biased, and would inherently control the flux of charged particles from a plasma passing through it to a substrate 33 disposed on the substrate holder 16 (See Column 2, Lines 60 - Column 3, Line 26). This rejection is based on the fact the apparatus structure taught above has the inherent capability of being used in the manner intended by the Applicant. When a rejection is based on inherency, a rejection under 35 U.S.C. 102 or U.S.C. 103 is appropriate. (See *In re Fitzgerald* 205 USPQ 594 or MPEP 2112).

Hayashi et al. does not expressly teach an electron etcher means in electrical communication with the substrate holder.

Kofuji et al. teaches that an etcher means (pulsed electrical bias) is in electrical communication with a substrate holder. (Column 11, Lines 24-38) Kofuji expressly teaches that electrons are drawn to the substrate during the positive swing of the pulsed electrical bias. (ex. Column 2, Lines 29-52)

It would have been obvious to one of ordinary skill in the art to modify the apparatus taught by Hayashi et al. to include an etcher means in electrical communication with the substrate holder. The motivation for doing so, as taught by

Kofuji et al. (Column 11, Lines 34-38), would have been to avoid notching and charge build-up on the substrate during etching.

Again, Kofuji et al. expressly teaches that electrons are drawn to the substrate during the positive swing of the pulsed electrical bias. (ex. Column 2, Lines 29-52) It is the Examiner's assertion that these electrons would inherently be capable of etching the substrate, since the apparatus taught by the combination of Hayashi et al. and Kofuji et al. is structurally the same as that claimed by Applicant. Moreover, the claims do not exclude additional etching performed by other (i.e. positive or neutral) particles, and indeed require that positive particles are drawn to the substrate during the negative swing of the electrical bias to neutralize the charge build-up on the substrate, just as taught by Kofuji et al. (ex. Column 2, Lines 29-52) This rejection is based on the fact the apparatus structure taught above has the inherent capability of being used in the manner intended by the Applicant. When a rejection is based on inherency, a rejection under 35 U.S.C. 102 or U.S.C. 103 is appropriate. (See *In re Fitzgerald* 205 USPQ 594 or MPEP 2112).

In regards to Claim 17, the charged particle controller means (additional structure 30) taught by Hayashi et al. is controllably electrically biased (Column 4, Lines 11-20; Column 5, Lines 57-58). This controllable bias would inherently adapt the charged particle controller to control the energy of charged particles being impacted on the substrate, determining the acceleration or reflection of charged particles from the additional structure. This rejection is based on the fact the apparatus structure taught above has the inherent capability of being used in the manner intended by the

Applicant. When a rejection is based on inherency, a rejection under 35 U.S.C. 102 or U.S.C. 103 is appropriate. (See *In re Fitzgerald* 205 USPQ 594 or MPEP 2112).

In regards to Claim 18, Hayashi et al. teaches a charged particle blocking means (insulating member 32; Figure 1). This insulating member would inherently prevent charged particles in the plasma from reaching the substrate unless the charged particles pass through the charged particle controller means. This rejection is based on the fact the apparatus structure taught above has the inherent capability of being used in the manner intended by the Applicant. When a rejection is based on inherency, a rejection under 35 U.S.C. 102 or U.S.C. 103 is appropriate. (See *In re Fitzgerald* 205 USPQ 594 or MPEP 2112).

10. Claims 19-22 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hayashi et al. in view of Kofuji et al. as applied to claim 16 above, and further in view of Lee et al.

The teachings of Hayashi et al. and Kofuji et al. were discussed above.

The combination of Hayashi et al. and Kofuji et al. does not expressly teach a pulse waveform power source adapted to electrically bias the charged particle controller means (additional structure) to direct electrons from the plasma towards the substrate.

Lee teaches that an additional structure 60 can be ac electrically biased by a pulse waveform power source 64 that alternately attracts negatively and positively charged particles towards the substrate. (Column 6, Line 50 - Column 7, Line 25)

It would have been obvious to one of ordinary skill in the art to modify the additional structure taught by Hayashi et al. and Kofuji et al. to be both ac and dc

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electrically biased by adding a pulse waveform power source connected to the additional structure, as taught by Lee. The motivation for doing so, as taught by Lee (Column 6, Line 50 - Column 7, Line 25), would have been to generate a pulsed charged-particle beam with a desired base voltage.

The Examiner notes that during the positive swing of the pulse waveform power source connected to the additional structure, negative particles, including electrons, would be directed to the substrate to perform etching, while during the negative swing of the pulse waveform power source, positive particles would be directed to the substrate. See Lee, Column 6, Line 50 - Column 7, Line 25. This rejection is based on the fact the apparatus structure taught above has the inherent capability of being used in the manner intended by the Applicant. When a rejection is based on inherency, a rejection under 35 U.S.C. 102 or U.S.C. 103 is appropriate. (See *In re Fitzgerald* 205 USPQ 594 or MPEP 2112).

Further in regards to Claims 20-22 and 26, the pulse waveform taught by the combination of Hayashi et al., Kofuji et al., and Lee cycles between a positive and negative potential to direct particles of alternating charge to the substrate. This pulse waveform would inherently be capable of working in concert with the pulse waveform connected to the substrate holder to direct enough ions of one charge towards the substrate to neutralize an existing charge on the substrate, without damaging the substrate.

Moreover, Lee teaches that the voltage supplied to the additional structure is a result-effective variable that determines which particles are energetic enough to reach the substrate and which particles are blocked. (Column 7, Lines 8-25)

Therefore, it would have been obvious to one of ordinary skill in the art to optimize the voltage supplied to the additional structure to optimize the energy of the charged particles that reach the substrate, such that electrons with kinetic energy less than 100 electron-volts reach the substrate to perform etching.

This rejection is based on the fact the apparatus structure taught above has the inherent capability of being used in the manner intended by the Applicant. When a rejection is based on inherency, a rejection under 35 U.S.C. 102 or U.S.C. 103 is appropriate. (See *In re Fitzgerald* 205 USPQ 594 or MPEP 2112).

Response to Arguments

11. Applicant's arguments filed 18 November 2005 have been fully considered but, to the extent to which they still apply, they are not persuasive.

In response to Applicant's argument that Hayashi et al. as applied to Claim 1 teaches only ion etching, not electron etching, the Examiner responds that Applicant's Claim 1 does not require electron etching, but only that electrons are directed towards the substrate. The Examiner believes that this new limitation has been addressed by the new rejection over Hayashi et al. in view of Lee. Moreover, Applicant's claims do not exclude etching by charged particles other than electrons, and indeed require that such particles be drawn to the substrate to neutralize charge build-up. Finally, the Examiner maintains that regardless of whether Hayashi et al., or even the combination

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of Hayashi et al. and Lee, *expressly* teaches that the electrons perform etching, the apparatus taught by the combination of Hayashi et al. and Lee would be *structurally capable of performing the intended use of electron etching*.

In regards to Applicant's argument that the apparatus taught by the combination of Hayashi et al. and Kofuji et al. as applied to Claim 16 does not include an electron etcher means, the Examiner responds that she has considered and given weight to the means plus function construction of the claim in accordance with 35 U.S.C. 112, Paragraph 6. The limitation of an "electron etcher means" has been construed to cover the corresponding structure described in the Specification of a pulse waveform power source connected to the substrate support. (Specification, Paragraph 59) This feature is taught by the combination of Hayashi et al. and Kofuji et al., as discussed in the rejection set forth above.

Applicant does not argue against the obviousness of combining Hayashi et al. and Kofuji et al., but rather submits that the combination of the teachings of Hayashi et al. and Kofuji et al. does not result in an "electron etcher means." The Examiner disagrees. Kofuji et al. does expressly teach that electrons are drawn to the substrate during the positive swing of the pulsed electrical bias. (ex. Column 2, Lines 29-52) It is the Examiner's assertion that these electrons would inherently be capable of etching the substrate, since the apparatus taught by the combination of Hayashi et al. and Kofuji et al. is structurally the same as that claimed by Applicant. Moreover, the claims do not exclude additional etching performed by other (i.e. positive or neutral) particles, and indeed require that positive particles are drawn to the substrate during the negative

swing of the electrical bias to neutralize the charge build-up on the substrate, just as taught by Kofuji et al. (ex. Column 2, Lines 29-52) In other words, the pulse waveform power source connected to the substrate support taught by the combination of Hayashi et al. and Kofuji et al. meets the structural interpretation of the means plus function language recited in Claim 16, *and* would be capable of performing the intended use of electron etching. It remains unclear to the Examiner why the apparatus taught by the combination of Hayashi et al. and Kofuji et al. should be any less capable of performing electron etching than the apparatus claimed by Applicant, even if ion etching *a/so* takes place during the opposite swing of the pulse waveform.

It is believed that Applicant's remaining arguments are either addressed by the rejections presented above, or are moot in view of the new ground(s) of rejection presented above.

Conclusion

12. Applicant's amendment necessitated any new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

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extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Maureen G. Arancibia whose telephone number is (571) 272-1219. The examiner can normally be reached on core hours of 10-5, Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571) 272-1435. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Maureen G. Arancibia
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